

Staff Meeting Bulletin
Hospitals of the » » »
University of Minnesota

Rheumatic Fever
In Childhood

STAFF MEETING BULLETIN
HOSPITALS OF THE . . .
UNIVERSITY OF MINNESOTA

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Published for the General Staff Meeting each week
during the school year, October to May, inclusive.

Financed by the Citizens Aid Society

William A. O'Brien, M.D.

I. LAST WEEK

Date: October 25, 1940
Place: Recreation Room
 Powell Hall
Time: 12:15 to 1:25 P.M.
Program: Movie: "Tugboat Mickey"

Digitalis Therapy
 E. A. Larson
 Phillip Hallock

Discussion
 E. A. Larson
 John LaDue
 A. D. Hirschfelder
 C. J. Watson

Present: 156

Gertrude Gunn,
 Record Librarian
 - - - -

II. MOVIE

Title: "Set 'em Up"

Released by: M-G-M
 - - -

III. ANNOUNCEMENTS1. MINNESOTA MEDICAL FOUNDATION

At the annual meeting of the Minnesota Medical Foundation, the following trustees were elected:

Four years

Lloyd Howard Rutledge '19
 Detroit Lakes
 Edwin J. Simons '24
 Swanville
 William Wallace Will '05
 Bertha

Three years

Gordon Campbell MacRae '24
 Duluth
 Russell James Moe '28
 Duluth
 Albert Markley Snoll '18
 Rochester

Two years

Jennings Crawford Litzenberg '99
 Minneapolis
 Owen Harding Wangensteen '22
 Minneapolis
 Cecil James Watson '26,
 Minneapolis

One year

George Arthur Earl '09
 St. Paul
 Erling Stoud Platou '21
 Minneapolis
 Robert Lawson Wilder '25
 Minneapolis

2. CENTER FOR CONTINUATION STUDY PROGRAM

November 4-9 General Surgery
 November 11-16 Obstetrics
 November 11-16 Proctology

3. VISITORS

Edward William Alton Ochsner,
 Professor of Surgery, Tulane
 University of Louisiana School
 of Medicine, New Orleans,
 November 7 - 9.

Edith Louise Potter, Pathologist,
 Chicago Lying-In Hospital,
 University of Chicago,
 November 14 - 16.

4. STAFF MEETINGS - (Past Record)
(11 Years)

<u>Year</u>	<u>Number of Meetings</u>
1929-1930	41
1930-1931	35
1931-1932	34
1932-1933	31
1933-1934	28
1934-1935	31
1935-1936	30
1936-1937	31
1937-1938	31
1938-1939	32
1939-1940	<u>33</u>

Total 357

- - - - -

IV. RHEUMATIC FEVER IN CHILDHOOD

Paul F. Dwan
Arild E. Hansen

(Assistance in the preparation of these materials was furnished by the Personnel of the Works Progress Administration Project 65-1-71-140, Sub-Project #254.)

Definition

Rheumatic fever is an infectious disease manifesting itself in all the tissues of the body, with a strong tendency to carditis and thus in its composite picture giving rise to the manifold condition known as the rheumatic state.

General Consideration

One of the most important problems we have today in the entire field of medicine is rheumatic fever. The devastating effect of this disease as shown by the high mortality rate and the physiologic crippling of its victims stands as a distinct challenge to the entire medical profession. Studies from various large centers, such as New York City, show that heart disease is the leading cause of death in girls of school age and second only to accidents in the boys. In the U.S. Registration Area, heart disease is the fourth largest cause of death in children of school age. Dublin states that a child of ten years has three times as many chances of dying from heart disease as from tuberculosis. For each death from heart disease, there are 10 to 17 patients suffering with the disease; whereas for each death from tuberculosis there are but 7 patients with the disease. In Philadelphia in 1936 rheumatic heart disease resulted in more deaths in those less than 20 years of age than, pertussis, measles, meningococcic meningitis, diphtheria, scarlet fever, and poliomyelitis combined. Kaiser states that 1 to 3% of all school children at any one time have rheumatic fever and that 8 to 10% of all school children at some time are afflicted with this disease. A

recent survey by Hedley of data from various Students Health Services revealed that about 1% of college students had evidence of rheumatic valvular heart disease. In our hospitals, Dr. Arnetta Becker found that from Oct. 1, 1939 to Jan. 15, 1940 seventeen of thirty-four deaths on the Pediatric service occurred in children of school age and nine of these were due to rheumatic fever. Our efforts to gain insight into the underlying nature of the disturbances in this disease have failed to bear the rewards seen in certain other disease conditions. Until we find the proper combination for an effective therapy in this disease, we will continue to find that in a 10-year follow-up period about one third of the children with rheumatic fever are dead and another one-third are cardiac cripples of various degrees.

Age of Onset

The disease usually has its inception in childhood. The peak of incidence in Minneapolis is between 5 and 6 years. This is somewhat younger than the figure given in other parts of the country and abroad.

Sex

The sex distribution seems to be equal between boys and girls. However, most authors feel there is three to four times as much chorea among girls as boys.

Family Incidence

It has been found that there is a definite familial incidence of rheumatic fever; there being three times as many cases among families of rheumatic children as among controls.

Hereditary Aspect

The hereditary feature was studied by Wilson and Schweitzer (1937) in 112 families observed 3 to 18 years. This study indicated that a hereditary factor making the bearer susceptible to rheumatic fever

was transmitted as a single autosomal recessive gene. The role of environment and contagion could not be determined.

Geographic Distribution

Rheumatic fever is fundamentally a disease of temperate climates. It is most common in cold damp climates, relatively rare in the southern zones, and almost unknown in the tropics.

Seasonal Incidence

In the temperate zone, the disease is primarily found during the cold damp months with peaks in the spring and late fall.

Morbidity

Statistics gathered among school children in several large cities in the United States show an incidence of rheumatic fever of 1%.

Social Distribution

Rheumatic fever is most frequently found in the urban population. Spot maps of our large cities show the greatest concentration of the disease among the overcrowded, cold, damp tenement districts. Congestion and poor hygienic surroundings seem to foster its spread.

Social Aspect

The serious social aspect of rheumatic fever has in the past been unrecognized. Poynton says, "the resigned acceptance of the fact that hundreds of young lives are damaged by rheumatism contrasts vividly with the extraordinary efforts that are made to prevent tuberculosis." The campaign waged against tuberculosis is widespread and it is becoming well nigh universal. A child of 10 years has three times as many chances of dying from heart disease as from tuberculosis. The subject of the prevention and cure of cancer has concerned many

institutions established and maintained for this particular purpose. However, cancer is less serious sociologically than rheumatic fever, in that it attacks more frequently the aged, and it does not produce cripples. Yet rheumatic fever, with its resulting carditis, has not been sufficiently considered as a public menace to seriously engage the attention of the medical profession as a whole.

Etiology

The etiology of rheumatic fever is unknown.

The streptococcus, which is extremely susceptible to environment, may, under changed cultural conditions, vary its characteristics as to morphology, virulence, and disease producing ability.

Vitamin "C" deficiency has been studied as a cause of rheumatic fever. A wealth of material has been gathered but no definite conclusive proof as to its relationship to rheumatic fever could be found.

Swift and others offer the suggestion that the cause of rheumatic fever is a filterable virus. This virus produces an allergic situation which responds to thermal, chemical, bacterial or traumatic insults which then produce the clinical picture of the rheumatic state. This hypothesis would explain many of the bizarre manifestations of rheumatic fever and may explain the frequent association of the streptococcus with the disease.

Recently Swift and Brown injected rheumatic exudates into the chorioallantoic membranes of chick embryos and produced characteristic lesions. This same picture was produced after the injection of material from the joints, pleura and from the nodules of erythema nodosum obtained from patients with rheumatic fever. This new angle of investigation may lead to more exact information regarding the etiology and pathogenesis of rheumatic fever.

Clinical Manifestations

Leseque' states that rheumatic fever "licks the joints and bites the heart." Our present conception of the manifold nature of the disease is due largely to Cheadle, who in 1889 was the first to point out the wide variety of manifestations that may occur in the rheumatic state. Following an acute infection which serves as the portal of entry, the character of the disease is dependent upon those tissues involved. These may be manifested in such constitutional symptoms as malaise, chill, headache, general soreness, fever, anemia, anorexia and malnutrition. There also are the specific symptoms dependent upon the involvement of joints, central nervous system, skin, lungs, pleura, kidneys, muscle, peritoneum, and heart. This acute stage usually lasts from two to four weeks. After this comes a period of indefinite length with low grade fever and rapid pulse. The transition from this stage of active infection into the stage of convalescence is gradual and variable. One of the greatest difficulties in the determination of the end of the particular attack is due to the marked tendency toward recrudescence.

I. Symptomatology and physical findings or specific manifestation of rheumatic fever.

1. Joint symptoms -- pain is the most consistent finding. There may be tenderness and swelling but redness occurs uncommonly. The extreme mildness of symptoms and the few joints involved are the characteristic features in children. Knee, ankle, hip, elbow and small joints are most frequently involved. Because of its mild nature rheumatic arthritis often is not heeded as a serious symptom by both the parent and the physician.

2. Subcutaneous rheumatic nodules -- a manifestation of rheumatic fever which too frequently seems to foretell the grave character of future events for the patient and which is often overlooked by the examining physician. These nodules are pin-head to almond (usually split pea) size and are perhaps the most

characteristic single sign in acute rheumatism. (Wilkinson) Coburn says they appear in 14% of cases.

3. Carditis -- peri-, myo-, endo-, pancarditis. Two features of carditis which seem to stand out particularly are (a) the great frequency that heart involvement occurs or is demonstrable during the acute phase of rheumatic infection, and (b) the relatively high incidence of carditis as the first manifestation of rheumatic fever. Eighteen per cent of a large series of cases had carditis as the initial manifestation of rheumatic fever. (Smith and Sutton) Prostration, weakness, dyspnea, cyanosis, precordial pain, tachycardia, tic-tac rhythm, distant or muffled heart tones, murmurs and pericardial rubs, even outspoken decompensation are signs of carditis but it is necessary to carefully examine the heart in all cases. According to Wilson, when symptoms of carditis could be recognized, signs of valvular damage were present, heart enlargement was greater, and the mortality was higher. Chronic valvular disease usually results from repeated attacks, seldom from one attack. According to Bland, Jones and White (1936), murmurs, especially the mid-diastolic rumbling sound at the cardiac apex may be due to cardiac dilatation. Persistence of a murmur after acute stage is the most reliable guide to residual injury in the valve. In 1000 cases studied only in 83 did all clinical evidence of heart disease disappear.

4. Chorea minor, easy to recognize when outspoken symptoms are present, but the mild and early cases are often overlooked. The use of finer tests -- "Placing the child under an acute strain such as is used here, namely: have the patient rest the palms of his hands squarely upon the examiner's, who holds his hands, palm upward, in front of him, and have the subject place his tongue between his lips without biting the tongue and then ask him to sit very still. Normally even a child of 3-5 years should be able to stay very quiet for a period of several minutes, whereas the child with mild chorea will have twitching of the face muscles and slight movements of the arms, fingers, or shoulder muscles."--

and pointedly inquiring into the emotional status of the subject are points necessary to detect many of these cases.

From the study by Jones and Bland, in 1000 cases of rheumatic fever, there were:

482 cases with chorea
134 cases (28%) with chorea alone
348 cases (72%) with other Rheumatic
Fever manifestations

Smith and Dodge (1938) in a study of 1052 rheumatic children found that 467 had chorea.

5. Skin manifestation -- Certain skin symptoms, erythematous (erythema multiforme, erythema nodosum, erythema annulare, erythema rheumatica) and purpuric in nature are from our experience frequently of rheumatic origin because they often occur during the course of rheumatic fever episodes.

6. Respiratory and other infections which often initiate, precede, or are associated with rheumatic episodes -- pharyngitis, tonsillitis, coryza, sore throat, "flu," scarlet fever, nephritis, myalgia and inflammation of serous membranes such as pleura, lungs, peritoneum and also the appendix.

7. General manifestations -- those which occur frequently in rheumatic fever yet are not specifically characteristic of that disease alone -- anorexia, malaise, weight loss, epistaxis, fever, weakness, "growing pains," pallor out of proportion to the hemoglobin concentration, prostration, lassitude, fretfulness, rapid pulse, moderate leucocytosis, secondary anemia, and malnutrition.

Mode of Onset

Coburn (1936) suggests three phases of acute rheumatic fever:

1. Acute upper respiratory infection - few days duration.
2. Latent period - 3 days to 6 weeks duration.
3. Rheumatic fever manifestation.

Onset preceded by: (Shapiro)

	No.	%
Cold	27	13.5
Sore throat	9	4.5
Pneumonia	4	2.0
Measles	2	1.0
Scarlet fever	12	5.9
Chorea	20	9.9
Other	9	4.5
Gradual onset	90	44.8
Not obtained	28	13.9
	201	100.0

Carditis itself has been often found to be the presenting symptom. Smith and Sutton state that 78 of 427 cases of heart disease gave no history of polyarthritis, chorea, joint, or growing pains. The occurrence of heart disease as the only manifestation of rheumatic fever varies with the climate as McLean points out that cardiac disease as the only manifestation of rheumatic fever appears 52% more frequently in Alabama than in New York City.

Recurrences

Roth, Lingg and Whittemore (1937) studied 488 cases for 8 years. At least one recurrence occurred in 68% of the cases and the first recurrence was not later than 3 years in 73%. The recurrence usually was the same as the initial attack.

Shapiro studied 342 cases over a varying number of years. He found that 178 or 52% had only the one attack so that more than one-half of them gave no history of recurrences. Below is given his table showing the incidence of recurrences.

Incidence of Recurrences in Juvenile Rheumatism

Total number of rheumatic children examined	342
Children with one attack only	178 (52%)
Children with recurrent attacks	164 (48%)

Age of puberty is important (White and Jones). After age of 16 years, 66% were free from recurrence of symptoms, whereas but 13% were free from symptoms before this age.

Association with Chorea

Sydenham's chorea has long been considered as part of the clinical picture of the rheumatic state. It is thought to be due to the action of both the infectious agent and its toxins. The former is thought to produce perivascular inflammatory changes and the latter to produce toxic changes in the cells of the cerebral cortex. The clinical picture of chorea with its purposeless movements, muscle weakness and mental irritability can be passed over on too hasty an examination.

Kaiser, in 1,181 cases of rheumatic infection, found chorea in 28% of his cases. This rheumatic manifestation seems to have a predilection for girls. Keschner found a sex distribution of three females to every male with chorea. There also seems to be a racial distribution in that a large number of cases are found in Jews.

Chorea has an interesting effect upon the prognosis of rheumatic fever, according to Jones and Bland. For some reason, it seems to lessen the degree of carditis and the mortality. Jones and Bland (1935) give the following figures for this condition.

Rheumatic Fever with Chorea
54% with heart disease

<u>Pure Chorea</u>	<u>Chorea with Rheumatic Fever</u>
3% with heart disease	73% with heart disease

Rheumatic Fever without Chorea
86% with heart disease

134 Chorea alone - 3% with heart disease
184 Chorea followed by Rheumatic Fever - 80% with heart disease
164 Rheumatic Fever, later Chorea - 66% with heart disease

Severe manifestations of Rheumatic Fever (e.g., precordial pain, pericarditis, congestive heart failure, also prolonged PR interval (electrocardiogram) -- twice as frequent in Rheumatic Fever alone as in Rheumatic Fever with chorea.

Chorea is a mild manifestation of Rheumatic Fever and is not especially conducive to rheumatic heart disease. (Jones and Bland)

105 cases chorea observed 3 years (Usher - 1938)
56 cases pure chorea
49 cases chorea with other Rheumatic Fever manifestations

14% pure chorea had heart disease
65% mixed chorea had heart disease

Incidence of Carditis

Rheumatic fever has a strong tendency to carditis with permanent damage. Herein lies the real danger of this disease. The incidence of carditis found by five writers is given below:

Hagge	50%
Gibson	74
Church	58
Kemp	80
Jones	86

With these figures representing the general statement of carditis, we can consider individually the types of involvement. Church finds endocarditis in 50% of his cases. Coombs, Swift and Less find some myocardial damage to be an almost constant finding.

Pericarditis

Coombs cites figures from the post-mortem records of the Bristol General Hospital. He found the following incidence of pericarditis:

1. Patients dying in 1st decade	100%
2. " " " 2nd "	83%
3. " " " 3rd "	42%
4. " " " 4th "	23%
5. " " after 40 years	26%
6. Taking all ages together	53%

Gibson in a recent study found that only 10 of 75 cases in children examined at necropsy showed no pericarditis.

Myocarditis

Tony feels that myocardial involvement is, as a rule, the most important feature of the rheumatic disease, for it is the condition of the myocardium, more than any other single factor, that in most cases determines the prognosis, and it is the myocardial damage which is responsible for death in most of the rapidly fatal cases. Coombs, from a study of the hearts

of fatal cases of rheumatic fever, concludes, "probably then, death in rheumatic heart disease occurring before the age of 16 is reached is more often due to acute inflammation of the myocardium than to anything else." Symptoms of cardiac insufficiency with dyspnea and usually with precordial pain are present, and the signs of early decompensation -- pulmonary congestion, cyanosis of the lips and fingers, and enlargement and tenderness of the liver appear.

At the present time we have data on 30 cases of rheumatic fever in which death occurred while on our service. As may be seen in the following tabulation signs of cardiac decompensation associated with an active rheumatic infection were present in 29 instances. Digitalis therapy was found to be of doubtful value in this type of cardiac failure. Only one child (D.S.) had chronic valvular heart disease with intermittent episodes of severe cardiac decompensation. In one instance (G.F.) staphylococemia was the cause of death. Subacute bacterial endocarditis did not occur in any of the cases we have been following.

Chart I

Month of Death

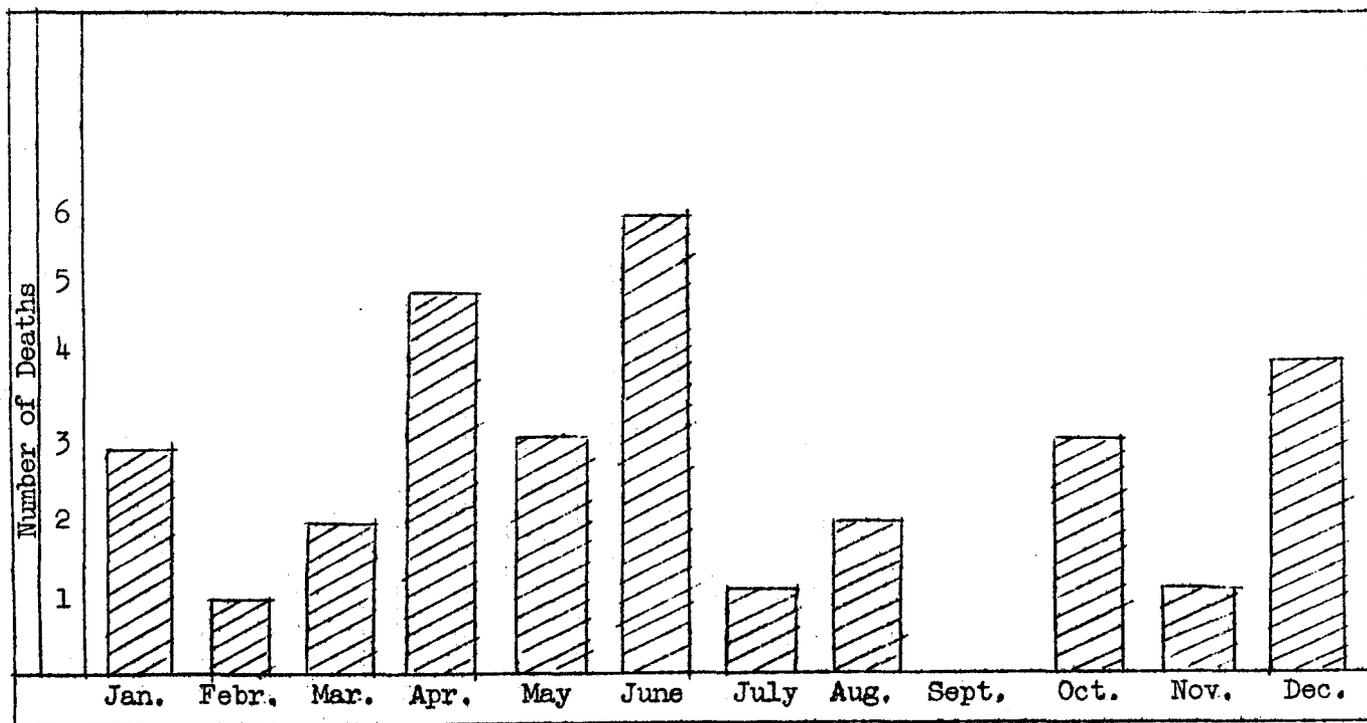


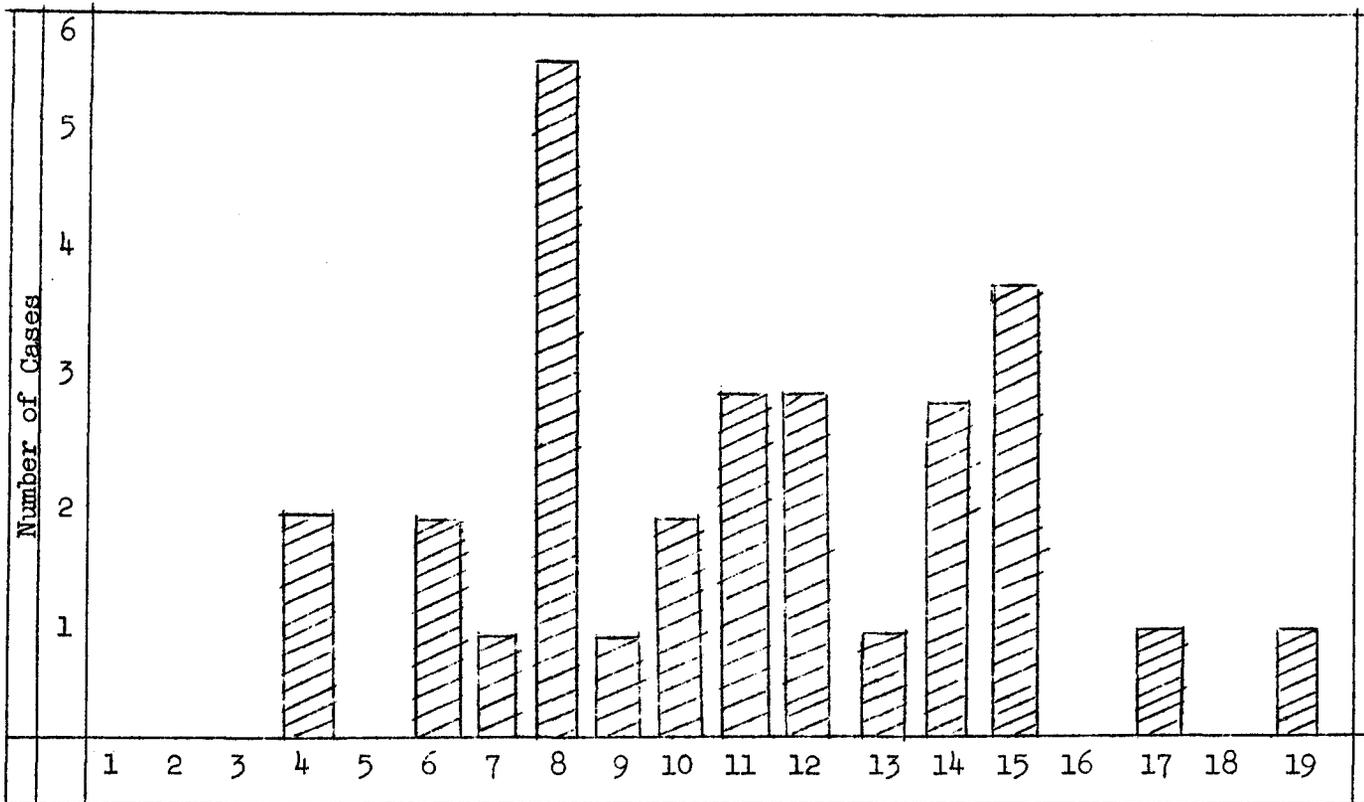
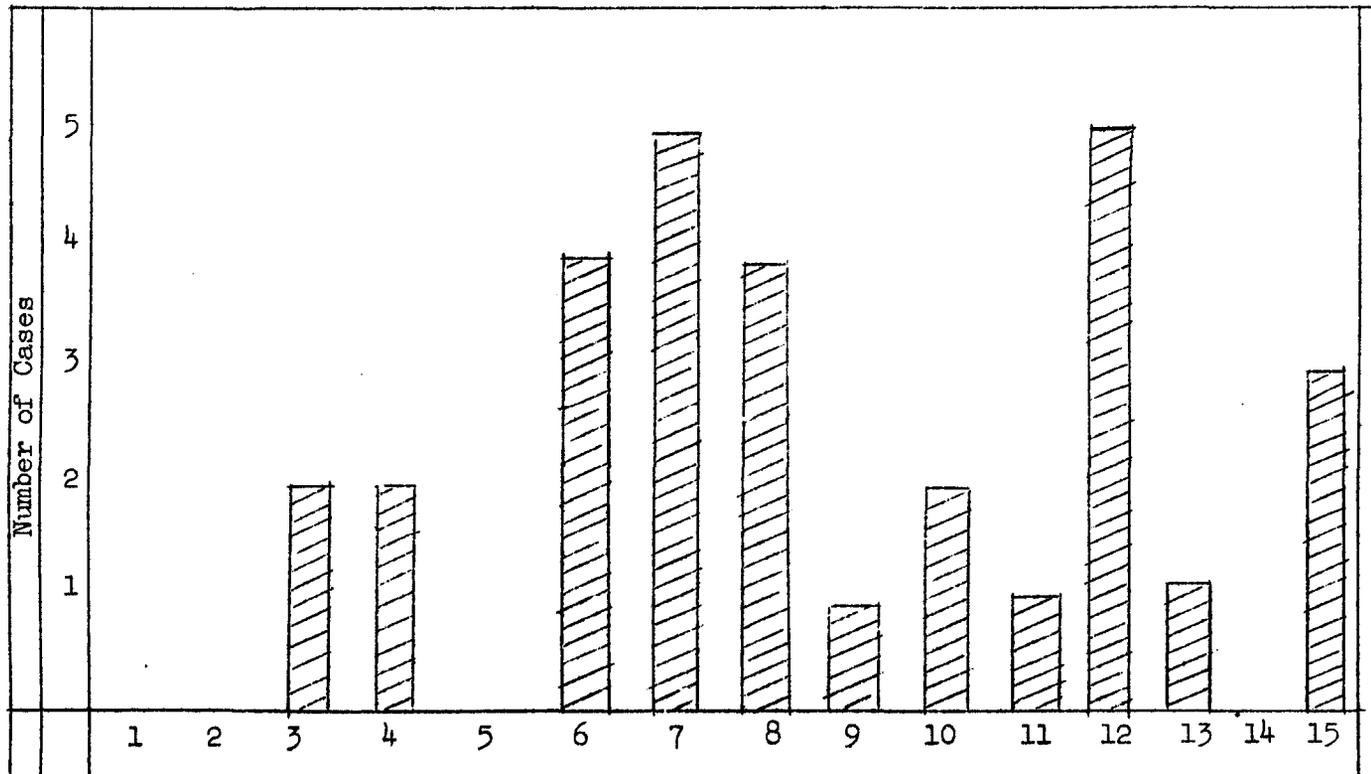
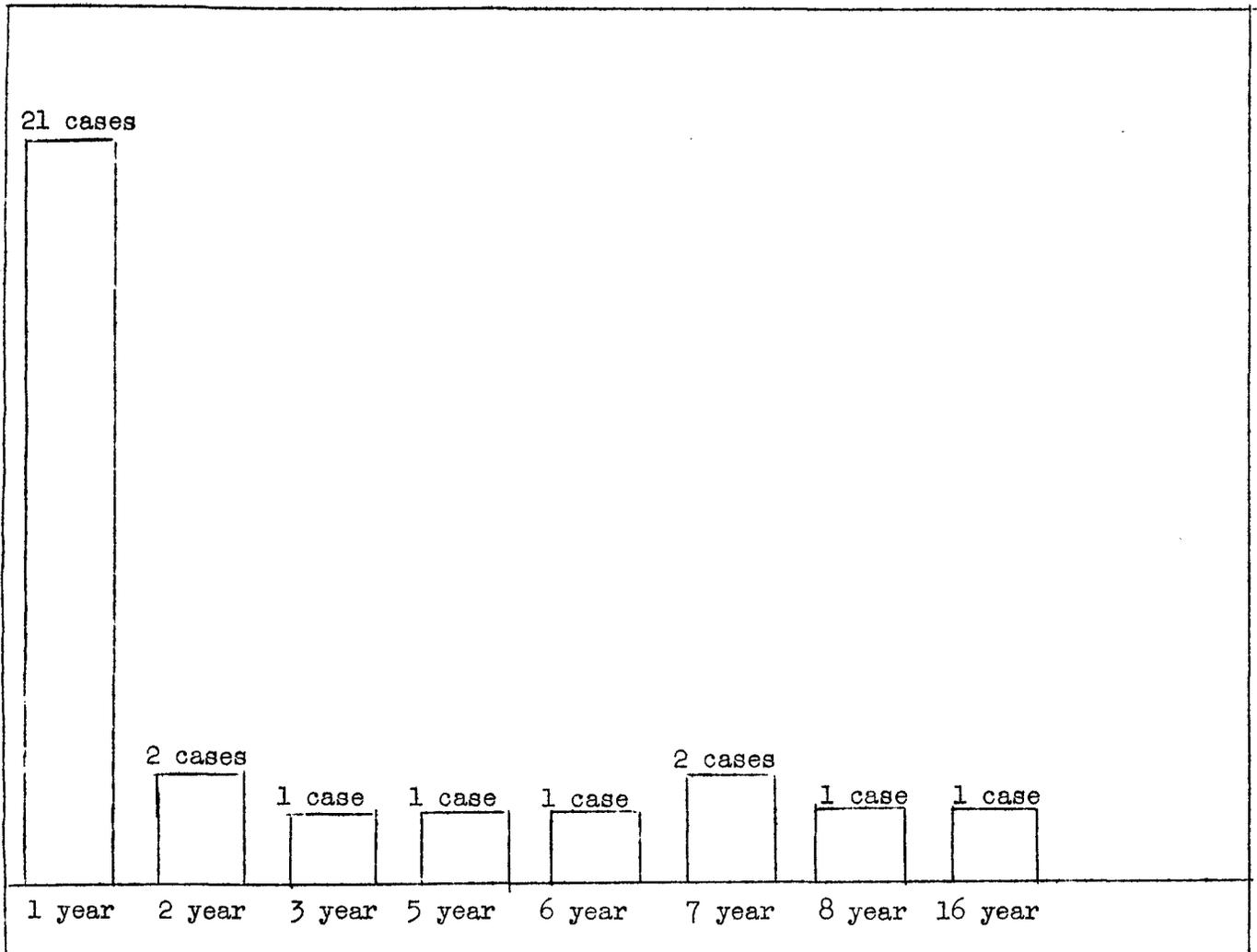
Chart 2Age at DeathChart 3Age at Onset

Chart 4

Interval between First Onset and Death

Endocarditis and Valvulitis

The importance of disease of the endocardium and heart valves is second only to that of myocarditis. Active inflammatory and destructive changes are serious but the fibrosis of repair may be just as severe in its effects on valve function. The mitral valve is the most frequent seat of extensive trouble, the aortic next in frequency, while the valves of the right side show a low incidence of serious involvement.

Active disease may promptly disappear, leaving the minimal degree of fibrosis limited to the valve orifice. With no further activity, this orifice is sufficient for the needs of the child's heart, but, as the heart chambers and valves reach adult size, the aperture at the mitral tip may remain in the original dimensions fixed by the fibrosis which followed the childhood attack. The stenosis is relative, develops gradually and insidiously, and in the absence of further active phases of disease may not give definite signs or symptoms until approaching maturity brings a rapid growth of the heart.

Course

The course of rheumatic fever varies tremendously. It may run its entire course in a month and leave behind no evidence of damage. It may invade the body and kill rapidly by the overwhelming nature of the infection. It may present the picture of one acute illness with recovery but frequent recurrences until the ultimate damage is great. It may simulate such a chronic disease as tuberculosis in which the disease process slowly burns, manifesting itself only slightly but producing more damage slowly but inevitably.

Diagnosis of Rheumatic State

The principal problems in dealing with rheumatic fever are two. First, the accurate diagnosis of the condition so as to be able to firmly go forward with the treatment. Second, the management of each case as an individual. No rules can be laid down and each case must be handled on its merits. Unless a definite diagnosis is made, there is a tendency to allow the child up after the subsidence of the initial febrile rise. It must be remembered that the patient then enters a prolonged period of convalescence in which the disease process is still present but manifesting itself only by a low grade fever. It is the care during this stage that determines the patient's outcome.

There are few diseases which may be diagnosed so easily, yet at times present such a complicated picture that accurate diagnosis is extremely difficult. In the following table we have listed the various diseases which are mentioned in the text books in pediatrics as being of importance in the differential diagnosis of this condition. This table is inserted only to show how complicated is the differential diagnosis of rheumatic fever.

Table II

Conditions to be considered in the differential diagnosis of Rheumatic Fever as mentioned in various pediatric text books. Enumerated to show the confusion possible in the diagnosis of the disease.

I. Painful joints and other pains	Gonococcic arthritis
Rheumatoid arthritis	Glandular fever
Upper respiratory infection with joint symptoms or abdominal pain	Osteochondritis
Scurvy	Trauma (sprain)
Septic arthritis	Pyuria
Osteomyelitis	Bacteremia
Poliomyelitis	Leukemia
Purpura-anaphylactoid	Brucellosis
Erythromelalgia	Serum disease
Myositis	Hemorrhagic diseases
Trichinosis	Non-rheumatic joint pains (growing pains)
Malaria	Appendicitis
Tuberculous arthritis	
Syphilitic arthritis	
II. Subcutaneous fibroid nodules	
Rheumatoid arthritis with nodules (rare)	
III. Cardiac	
Congenital heart disease	Tuberculous pericarditis
Diphtheritic myocarditis	Suppurative pericarditis
Interstitial myocarditis	Gonococcic carditis
Accidental or functional murmur	Subacute bacterial endocarditis (streptococcic viridans)
Beriberi	Pleurisy
Glycogen storage disease	Pneumonia
Severe anemia	Psychic tachycardia
IV. Chorea	
Habit spasm	Vascular lesion
Imitation	Hyperthyroidism
Encephalitis	Physiologic myxedema of adolescence
Athetoid movements with cerebral lesions	Hysteria
Dystonia musculorum deformans (Torsion spasm)	Poliomyelitis
Nervousness with emotional disturbance	Familial ataxia
Multiple neuritis	Certain cases of poisoning
V. Specific bacterial infections	
Acute appendicitis	
Acute osteomyelitis	
Meningococcemia	
VI. Miscellaneous conditions	
Typhoid and paratyphoid fever	
Erythema nodosum and multiforme	

It was believed that one might obtain some information valuable in simplifying the differential diagnosis of rheumatic fever by determining the frequency of various diagnoses made by the physician who referred the case to our clinic. At present we have reviewed 167 case records of subjects with rheumatic fever who were seen in the University Hospitals and Out-patient Pediatric-Cardiac clinic from 1931 to 1940.

Table III

Rheumatic fever	86
Alone	28
Rheumatic arthritis	9
Alone	4
Joint pains	2
Joint stiffness	3
Carditis	49
Rheumatic heart disease	33
Heart disease	5
Heart murmur	3
Heart infection	6
Endocarditis	2
Leakage	1
Mitral heart	8
Decompensation	1
Chorea	42
Congenital heart disease	2
Miscellaneous	37

We may have been somewhat liberal in our interpretation of some of the diagnosis as being rheumatic fever, for instance, "joint stiffness" as rheumatic arthritis or "heart" as being rheumatic carditis. However, the group of 37 cases classified as miscellaneous is of particular interest and for that reason is inserted here.

Table IV

37 miscellaneous diagnoses made by referring physician in 167 cases of rheumatic fever

Appendicitis	7	Irritable nervousness	1
4 operated upon (1 acute suppurative)		Nephritis	1
3 not operated upon		Pleurisy	1
Abdominal pain	4	Sinusitis	1
Poliomyelitis	3	Adenopathy	1
Osteomyelitis	2	Pott's disease	1
Septicemia	1	Pneumonia	1
Erythema nodosum	1	No diagnosis	10
Symptomatic purpura	1		
Low grade fever	1		

This table shows that the most frequent confusion in diagnosis arises in those cases in which abdominal pain is present.

It is imperative that rheumatic fever is considered in the differential diagnosis of possible appendicitis in children.

Another problem is the differentiation of salient features of these two conditions between the mild symptoms of rheumatic fever and the non-rheumatic pains of childhood. Shapiro has tabulated the as given in the table following.

Table V

The Differences between Non-Rheumatic "Growing Pains"
and Joint Pains of Subacute Rheumatic Fever

	<u>Non-Rheumatic "Growing Pains"</u>	<u>Joint Pains of Subacute Rheumatic Fever</u>
<u>Time of pain:</u>	Soon after going to bed. Pain gone in morning. No pain on motion.	Worse on arising. Exaggerated by motion. Difficulty in walking; may cause limp. Pain present during most of day; disappears on getting warm in bed.
<u>Location of pain:</u>	In muscles of thighs and legs. Child vague in pointing out site of pain.	In joints themselves. Child points to knees or ankles. Often complains of pain in joints of upper extremities also.
<u>General Health:</u>	Usually good.	Usually poor.
<u>Other Signs of Rheumatic Activity</u>	Usually none.	Common; may have frequent nose-bleeds, unexplained fever, pallor, abdominal cramps, undernourished. Evidence of carditis.
<u>Objective Findings in Joints:</u>	None	Often joints are slightly swollen and hot.
<u>Family History of Juvenile Rheumatism:</u>	Uncommon	Very common.

Another difficult point is the evaluation of cardiac findings. Frequently, the question of congenital heart disease

arises. The table below presents the characteristic features of each.

Differential Diagnosis of Congenital and Acquired Heart Disease
(Dwan)

	<u>Congenital</u>	<u>Acquired</u>
<u>Age:</u>	Usually discovered in early infancy.	May develop any time in life but usually after infancy.
<u>History:</u>	No rheumatic infection.	Rheumatic infection.
<u>Symptomatology:</u>	Lack of aeration: <ol style="list-style-type: none"> 1. Cyanosis 2. Clubbing 3. Delayed mental growth 4. Delayed physical growth 5. Dyspnea due to poor oxygenation 	Passive congestion: <ol style="list-style-type: none"> 1. Edema 2. Enlargement of liver and spleen. 3. Dyspnea due to edema 4. No cyanosis 5. Clubbing a late event
<u>Progression of Findings:</u>	<ol style="list-style-type: none"> 1. Cardiac findings fail to progress. 	<ol style="list-style-type: none"> 1. Progressive changes in findings.
<u>X-ray Changes:</u>	Lack of enlargement of left auricle as seen in seophagogram.	Enlargement of left auricle, as seen in esophagogram.
<u>Apex Beat:</u>	Feeble or unchanged.	Accentuated.
<u>Murmur:</u>	Character: Loud, harsh, musical Location: At base	Character: Soft blowing. Location: At apex.
<u>Blood Changes:</u>	Polycythemia. Increase in hemoglobin	Anemia. Leucocytosis
<u>Vascular Changes in Eye Grounds:</u>	With cyanosis: <ol style="list-style-type: none"> 1. Irregularities in lumina of the vessels, which become tortuous like large angle worms. Knapp, 1861. 2. Vessels become darker. 3. Peripheral twigs distended. 4. Small hemorrhages. 	No characteristic changes.
<u>Electrocardiograph:</u>	<ol style="list-style-type: none"> 1. Right axis deviation 2. Great amplitude to complexes. 3. Great variation in the height of the complexes. 	Changes of conduction and direction of amplitude of complexes. Secondary alteration of axis deviation. Mitral -- right axis deviation. Aortic -- left axis deviation.

Presence of systolic murmur at the apex on routine examination may be the only sign suggestive of heart disease. Steuer and Fineberg (1938) followed 33 cases for 10 years or more and found that 27% acquired serious valvular heart disease (chiefly mitral stenosis); 61% still had the systolic murmur, but nothing more; 12% had lost their murmurs.

Laboratory Data helpful in determining presence of rheumatic activity

Routine laboratory data -- hemoglobin, leucocytes and differential white blood cell counts aid in determining rheumatic activity. A falling hemoglobin or failure to rise if previously low, often may be the result of rheumatic activity. The leucocyte count has proven to be of relatively little value to us, especially in mild cases, in following the progress of rheumatic fever subjects. Juster on the other hand finds this to be a valuable guide in determining the activity of the infection in adult subjects. A shift to the left as determined by the Schilling hemogram often aids materially in the detection of rheumatic activity.

Sedimentation rate of red blood cells -- this procedure is probably the most useful of the routine laboratory procedures in determining rheumatic activity. In our studies we have used the large Westergren tubes. We consider a falling rate in the neighborhood of 10 mm. in 60 minutes or less to be within normal limits. In many instances the recommendations in any given case rest upon the outcome of the rate of settling of the erythrocytes.

Weltman reaction -- this is another simple laboratory procedure, the usefulness of which we are attempting to evaluate in the determination of rheumatic activity. Diluted serum is added to ten test tubes containing concentration of CaCl_2 from 0.1% to 0.01% and are numbered 1 to 10 respectively. The tubes are placed in boiling water and read after 15 minutes. Coagulation of the protein occurs normally in all concentrations up to tube number 6 and this is then referred to as Weltman reaction of 6. In the presence of active infection we

find readings of 1 to 5. This phase of the study has been reported by Levinson⁸ in relation to rheumatic fever. We are attempting to compare the Weltman reaction to the erythrocyte sedimentation rate in the light of other clinical data in various phases of rheumatic infection, in order to determine the usefulness of this procedure in ascertaining the degree of rheumatic activity.

Electrocardiogram

The electrocardiogram is an important instrument in determining evidence of rheumatic activity. Swift⁷ states that 95% of subjects during the acute phase of rheumatic fever show electrocardiographic changes indicative of rheumatic activity.

Master and Jaffe (1934): Each of 63 cases of rheumatic fever demonstrated electrocardiogram unequivocal signs of severe myocardial involvement.

RST change	85%
P-R elongation over C_2	53%
T wave inversion	40%
Iso-Electric T. waves	29%

Keith (1937) in 100 patients with rheumatic fever: some time during the 2 years of observation found:

26%	P-R interval over 0.20 sec.
52%	P-R interval over 0.18 sec.

The following electrocardiographic changes are those most frequently interpreted as indicative of rheumatic involvement of the myocardium:

1. P-R interval prolonged
2. P notched, especially P_3
3. Swift lead
4. Pardee Q_3
5. S-T interval not isoelectric, and more than 0.5 mm. elevated or depressed in relation to PR
6. $P_1 \&_2$ and $T_1 \&_2$ negative
7. P & T Height more than 5 mm.
8. QRS complex, slurring, splintering, widening, M & W forms.
Upper limit of normal 0.1 sec.

9. Low amplitude of all waves
10. Miscellaneous

The fourth or chest lead is proving of value in the diagnosis of acute carditis. It is felt that the fourth lead elicits changes by reflection or damage in heart areas which are "silent" to the conventional leads.

X-ray

Roentgenologic investigation is warranted at the onset of the disease and periodically throughout the life of the patient who suffers heart damage. The x-ray is invaluable in following the effect of this disease on the heart.

Pathology

With the exception of the small sessile

vegetations on the cardiac valves, the exudate in the pericardium, and the subcutaneous nodules, the principal morbid changes in rheumatic fever are of microscopic dimensions. These microscopic lesions occur largely in corrective tissue, particularly in and around small vascular branches and are known as Aschoff bodies.

Prognosis

The prognosis of rheumatic fever depends to a large extent upon the carditis resulting from the infection. The incidence of carditis has been discussed above. The prognosis of rheumatic heart disease may be considered below. Stroud states that of 307 cases of rheumatic heart disease 40% were totally disabled or dead at the end of 10 years.

Prognosis of Rheumatic Infection During a Ten-Year Period

Author	Period	No. of Patients Traced	Average Age at Onset	Average Duration of Infection: Years	Deaths %	Valvular Heart Disease %
Ash	1922-32	416	6.8	7.5	22.3	66.1
Jones & Bland	1921-32	1000		8.0	21.7	70.6
Kaiser		564		5.8	8.2	64.0
Findlay	1920-29		7.0	5.0	19.9	60.9
Stroud	1922-31	307	7.3		31.9	
Wilson	1916-27	355	7.3		10.8	79.5

The prognosis of rheumatic fever has been reported by the six authors given above. It will be seen that their mortality varies from 11 to 32%.

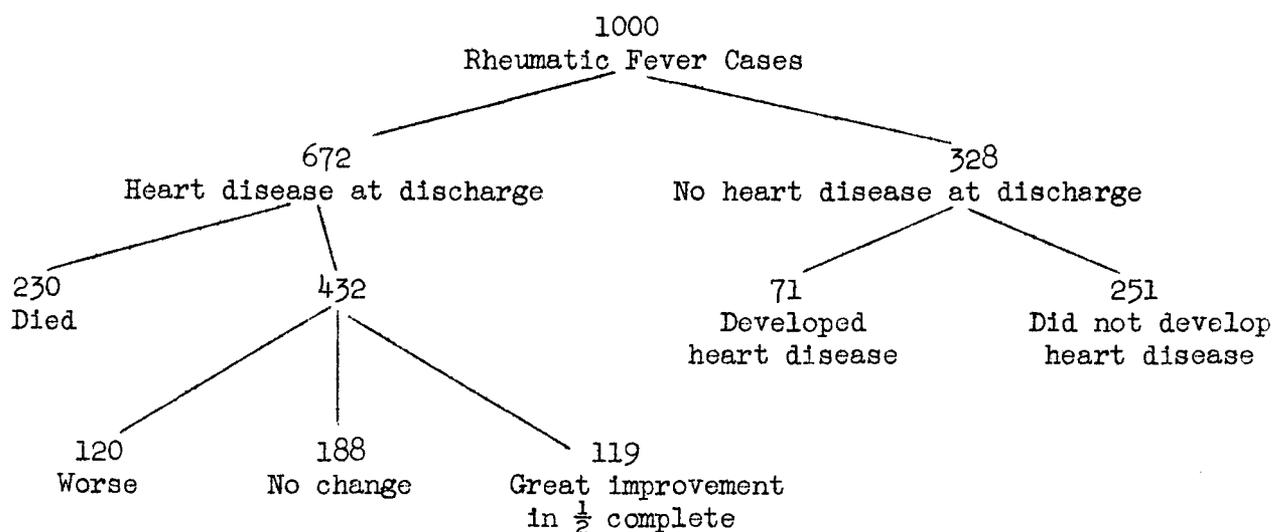
John Lovett Morse reviewed 100 cases of heart disease which had been seen in his office and followed from 10 to 30 years.

Dead	36%
Cardiac invalids	3%
Hearts normal	37%
Hearts slightly damaged	18%
Hearts not examined	6%
Alive and well	61%

According to the studies of Jones and Bland:

Pure chorea -	0.7% mortality
Rheumatic Fever with chorea -	14% mortality
Rheumatic Fever alone -	32% mortality

Of 337 rheumatic subjects studied, 112 had died during the 20 year period (Wilson).



Summary

- 242 - Dead, majority from active rheumatic fever with congestive failure; average age 13 years.
- 310 - Living and well, no heart disease.
- 427 - Heart disease
 - 140 - Moderate to marked limitations of activity, poor prognosis.
 - 287 - No limitations of activity (+ living and well 310 = 597).
- 21 - No information available.
- 1000 - These 1000 children all had adequate bed rest in hospital. T. Duckett Jones, J. Ped. 14:395, 1939.

According to White and Jones, subacute bacterial endocarditis is the cause of death in about 4% of patients with rheumatic fever. From 50 to 65% of patients with subacute bacterial endocarditis have previously had rheumatic fever. Holmes (1938) says that previous rheumatic endocarditis was present in 65 - 90% of cases of subacute bacterial endocarditis.

Treatment

The care of a patient with rheumatic fever depends on an understanding of the acute and chronic aspects of the disease and the points discussed above. Rheumatic fever has four distinct divisions in its clinical course.

The first is the period of invasion in which the child suffers with some acute infection. The second is the period in which the body reacts to the involvement

of whichever body tissues have been invaded. This is the period of multiple joint pains, fever, tachycardia, pallor, etc. The third is the period of convalescence and the fourth is the lull after the storm when evaluation of damage must be made. Because each stage is different, therapy must vary as the disease progresses. The stage of invasion presents its own peculiar problems and therapy is dictated accordingly.

During the stages of acute infection and convalescence bed rest seems to be the only form of therapy which has stood the test of time. Bed rest throughout the duration of the infectious stage of the disease is at present our objective. Research has suggested many ideas -- heat therapy, foreign protein shock, convalescent serum, convalescent scarlet fever serum, sulfanilamide, high vitamin diets, multiple transfusions but none of these have so far proved worthy of

general use. After instituting strict bed rest the question arises as to how long this must be maintained. The average case of rheumatic fever lasts approximately four months. This means that some cases will be over in a few weeks and others will require two or more years.

One of the most difficult problems in the management of rheumatic fever is the determination of the end of the period of convalescence. Consideration must be given to the symptoms, physical findings and laboratory data. Joint pains, fever precordial pain, nose-bleeds, tachycardia, malaise are all symptoms which indicate continued activity. Physical findings should be divided into general and local. Under general findings we note pallor (out of all proportion to the degree of anemia), joint findings, skin manifestations, and under local we list the findings on examination of the heart. Tachycardia, arrhythmias, heavy cardiac impulse, pleural or pericardial friction rubs changing, murmurs, and accentuation of the pulmonic second sound are physical evidences of active carditis. Laboratory data such as a rapid sedimentation rate, a low Weltman reaction, a high leucocyte count, a progressive anemia, a toxic blood smear, albumin and blood in the urine all indicate continued trouble. The electrocardiograph yields evidence of myocardial damage. As tracks in the snow, it tells of damage which has been done. Only if progressive changes are found does it necessarily indicate continuing infection. The x-ray records the extent of damage done to the heart but only in a long-time study does it present the picture of progressive disease. Consequently, it is of very little help in evaluating the status of rheumatic activity at any given time. Consequently, the determination of quiescence of the infectious process, in other words, the time when the child may be allowed to return to normal activity, depends on judgment, and an understanding of the nature of rheumatic fever. Conservatism is the proper attitude, evaluation of all the points mentioned, and care of each case as an individual are necessary for a successful outcome.

No specific measures have as yet been devised to combat the infection itself. Resumption of activity should be gradual, such as sitting up in a chair for one-half hour twice daily for one week, then increase 15 minutes daily until the rest in bed is equivalent to a nap in the late morning and a long nap in the afternoon. After about two weeks allow bathroom privileges and increase the indoor exercise periods 15 minutes daily for 2-3 weeks, then allow the child to go outside. With the gradual resumption of activity, most important is the effect on the patient and the various laboratory tests which must be subject to the clinical judgment of the physician in the detection of signs of activity of the rheumatic infection for the further handling of the case. According to a number of investigators the indications for removal of the tonsils and adenoids are the same as if the rheumatic infection had never occurred. If removal of the tonsils and adenoids is deemed advisable it is best to wait until several weeks after all signs of rheumatic activity have disappeared.

According to White and Jones, subacute bacterial endocarditis is the cause of death in about 4% of patients with rheumatic fever. From 50 to 65% of patients with subacute bacterial endocarditis have previously had rheumatic fever. Holmes (1938) says that previous rheumatic endocarditis was present in 65 - 90% of cases of subacute bacterial endocarditis.

The therapeutic effect of tonsillectomy on rheumatic infection has been the subject of considerable discussion for a number of years. Ash in a 14 year study of 522 cases concluded: Tonsillectomy did not prevent recurrence of rheumatic manifestations. Presence or absence of tonsils had no effect on developing rheumatic fever or cardiac complications or death rate. Exacerbation frequently followed when tonsillectomy was performed early in the course of the disease.

Allan and Baylor (1938) studied 108 cases in 1935 who had had tonsil and adenoid removal because of rheumatic fever

from 1910-24. Average age of living patients, 26.4 years. Heart complications developed in 6 of 49 subjects who did not have signs of involvement at the time of operation. Recrudescence of rheumatic fever occurred in 43.5% and

was common in the first 5 year period after operation. Most patients who had recrudescence during this period died of heart disease.

Sutton and Dodge (1938) in 99 children with chorea treated with fever therapy compared with 60 cases not treated with fever found:

	<u>Patients Observed 1 - 3 Yr.</u>		<u>Observed 4 - 6 yr.</u>	
	Treated (48 cases)	Untreated (23 cases)	Treated (51 cases)	Untreated (37 cases)
Chorea	31.5%	37.5%	40.0%	51.0%
Polyarthrititis	6.0	32.0	6.0	33.0
Heart disease	12.5	26.0	29.4	35.0
Death from heart disease	2.8	13.0	1.96	10.8

Reports on the value of convalescent serum are not conclusive. Convalescent rheumatic fever serum, 30, 92, 110 and 140 cc. were given to four patients with acute rheumatic fever attacks. No change in the condition of the patient or in the laboratory data was obtained. (Friedman, Klein and Rosenblum, 1938). Archer, Garfield and Zarne (1936) administered 5 - 13 cc. of convalescent serum to four patients with acute rheumatic fever with sufficient response to indicate further trial.

Digitalis has long been the subject of considerable controversy as regards its value in heart disease in childhood. Some authorities recommend a trial period with this drug while others condemn its use. It is readily admitted that favorable clinical responses are not frequent, yet in certain instances benefit is obtained from its use. In the badly damaged heart, digitalis will not help. This is indicative of a poor prognosis. Indications for digitalis are considered to be:

1. Congestive heart failure
2. Auricular fibrillation
3. Milder cardiac symptoms such as cough, some dyspnea and overacting heart.

Powdered digitalis (0.1 gm. = 1 cat unit) weight in pounds x 0.015 = gm. necessary (Eggleston). One-half by mouth stat. One-fourth in 6 hr., one-eighth in 6 hr. Must watch for signs of digitalis intoxication -- premature contraction and vomiting. Frequent

electrocardiograms useful. Maintenance -- 0.05 - 0.10 gm. two to three times daily

Even with the numerous therapeutic procedures used in rheumatic fever one is usually left with the feeling of frustration as regards the general success of treatment in this condition. It appears that the best therapeutic measure so far known has been pointed out by nature herself, namely, that this disease varies greatly in its geographic distribution. The impracticability of sending children with rheumatic fever to warm climates such as Porto Rico, Cuba, Southern Florida in the overwhelming majority of instances is too obvious to stress to any extent. The need for a specific chemo-therapeutic agent in rheumatic fever has long been known. When the effect of sulphanilamide became known it was not long before it was recognized in many parts of the world that this remarkable agent was observed to be without benefit in the acute phase of this disease. However, the encouraging recent report of Coburn offers a hope for the prevention of the worst feature of rheumatic fever, namely, that of the profound tendency to recur. It is the repeated attacks of the disease which cause it to be so destructive. Coburn administered 2 to 3 grams of sulphanilamide daily for a period of six months or more to three different groups of children with rheumatic fever. In 183 of the 184 subjects there were no

signs of a flaring up of the rheumatic symptoms during this time. It is hoped that this promising lead will be borne out by more extensive investigation.

Our experience with this type of man-

agement of rheumatic subjects has been very limited. However, the following table summaries in experiences with the use of sulfanilamide as a prophylactic agent, in Pediatric-cardiac Clinic for 1939-40.

Table VI

<u>Treated</u>	<u>Condition</u>	<u>Controls</u>	<u>Condition</u>
.	Good	.	Satisfactory
.	"	.	Good
.	"	.	Satisfactory
.	"	.	Mild symptoms
.	"	.	Good
.	Colds, good	.	Good
.	"Flu," good	.	Good
.	Vertigo at first, good	.	Mild chorea
.	Good	.	Mild rheumatism - chorea
	(1938-39)	.	Sulfanilamide not tolerated
			Symptoms of rheumatic fever Dec. - February.

The care of the heart damaged by rheumatic fever consists of regulated life, within the capabilities of the cardiac function, digitalis and quinidine for the irregularities and decompensation

so that the damaged organ may have a chance to return to health or at least perform its function to the best of its ability.

V. GOSSIP

Today is All Saints Day, a feast day of the first order when Mother Church remembers her sons and daughters who excelled in the practice of the virtues and in the way they attested to their faith, many of them by going the route of martyrdom. Each day one or more martyrs or saints are remembered in the church calendar except in houses of religion when just before dinner an extended list is read. During the year this covers all whose names are so honored....And speaking of saints' names, Archbishop John Gregory Murray has just announced that the name of the new Minneapolis loop parish will be St. Olaf. Another believe it or not is that St. Bridget was a Scandinavian, coming from Sweden. I was reminded of this the other evening when Nurse Birgit Tofte of the Ancker Hospital Staff introduced me at the Annual Dinner of the Minnesota Nurses Association. Miss Tofte, whose accent betrays her recent residence was sorrowed during the invasion of Norway by the death of her mother in an air raid....He was strong, yes, he was so strong that he could run a hundred miles a day without tiring. He had battled physicians all over the country on their ideas about diet; he had driven all to cover. He was probably the strongest, healthiest man in the world; at least, so he told his "classes." When they took him to police court and shoved him in the bull pen, he fainted. He fainted a second time after conferring with his lawyer (do you think it could have been the retainer fee?). A group of us were ready to appear against him, for he had advertised that he could cure cancer, tuberculosis, syphilis, and other serious organic diseases by diet. In Minnesota we have a law which prohibits untruthful statements of this nature. Probably because of the determined opposition to his ideas, or because he had heard of the galaxy of experts who were to appear in the court, he decided to plead guilty and is now far away, having been given a suspended sentence....Basil C. MacLean, Director, Strong Memorial Hospital, Rochester, New York writes to Mr. Amberg as follows: "Dear Ray: You were good enough to send me copies of your Staff Meeting Bulletin when I was in New Orleans and I have been bragging about them during the past five

years here in Rochester. Now you have been good enough to send a copy of Volume X to us and this is more than a perfunctory note of thanks. I am putting it in the Medical Library with your compliments and in one more of many things, we doff our hats to Minnesota." Not to be outdone, A. C. Bachmeyer, Director of University Clinics, University of Chicago, writes, "My dear Dr. O'Brien: I am pleased to acknowledge receipt of the bound volume of your Staff Meeting Bulletins for 1938-39. We are very happy to have a record of these transactions. Kindly accept my sincere felicitations upon the excellent work accomplished by the staff meetings which you are conducting."Last Sunday's papers carried the sad news of the death of Dr. Walter List, former superintendent of the Minneapolis General Hospital. Dr. List has been superintendent of the Jewish Hospital in Cincinnati for the past ten years. When he was in Minneapolis, he took the Cincinnati papers and read avidly of "home" news. When he went back to Cincinnati, he subscribed to the daily Minneapolis papers. Dr. List was a perfectionist. Everything he did, he did well. Details too small to engage the attention of the average man were his meat. As a result, there was no better informed administrator of the affairs of his institution. Driving himself with a determination that knew no respite, he felt that those under him should give equally of themselves to their jobs. There was no such thing in his day as coming to work late or leaving early. No administrator of a municipal institution ever looked with greater favor on a University affiliation. He thought teaching and good hospital service were synonymous and now he is dead at 54...At the reunion of the twenty year class (1920) held at the Town and Country Club last Friday evening, nearly half the members were present. Those who came from a distance were guests of the local men. Each, in turn, spoke of what had happened since he left school. There was sadness; there was joy; there was accomplishment; there was failure. Some who had problems while in school that the others did not know about told of them for the first time. So enthusiastic did they become that they hope to have such reunions every year.

As a matter of fact, probably the twentieth year is the ideal time, and there should be no other. About this time the average person has just reached his place in society. Later or before, the situation might not be so favorable. Next year, the 1921 class will meet under a similar arrangement....The Nobel prize winner and distinguished artist Sigrid Undset spoke with great difficulty at West High Auditorium Sunday night. There was the language problem, and furthermore, the large hall was a challenge to even those of strong voice. But the worst feature was this -- the boy who was in charge of the public address system had forgotten all about it and failed to appear. Dignified of mien, her appearance resembled greatly the character of Queen Victoria in the movies. Cold fire blazed as she spoke of her feelings concerning those who now dominate her country. If other dominated peoples feel as she does, there will be no peace until the minorities are allowed to go their own way....

..Radiologist Hymer Friedell, who received his advanced degree this year, has been studying with Dr. Max Cutler and his associates at the Tumor Clinic in Chicago. He plans to spend the next six months at the Memorial Hospital in New York and then go to San Francisco to be with Radiologist Robert Spencer Stone who gave the Citizens Aid Society Address here a few years ago.....Dr. Carl Lind, who has been connected with our staff in the Departments of Surgery and Tumor Therapy, has gone to Washington, D.C. to take a full-time governmental position as pathologist in a research capacity. Carl's many friends wish him well in his new position.....

..Milwaukee train service makes it possible to attend an evening meeting there and be home the next morning with only a "loss" of an afternoon. I went down this week on the Hiawatha which leaves here at 12:30 noon. The 326 miles from St. Paul to Milwaukee is made in a few minutes less than five hours. Returning the train leaves either at 12:00 or 1:00, arriving here at 8:00 or 9:00. Former Minnesota obstetrician Robert Edmund McDonald, '26, met me at the train. At the University Club gracious smiling Jim Kelley had already assembled the boys. Executive Secretary Kelley has lost 80 pounds, but his 6'5" frame carries the remaining 200

very well. Many Minnesotans know his father, Dr. Francis H. Kelley, of Merrill, Wisconsin. We had a dinner such as only the University Club can serve. In anybody's Guide to Good Eating this place is tops. The pathologists of Milwaukee turned out, and everyone had a good time except one ardent proponent of a certain candidate for the presidency, such candidate not being popular with any of the others present. The offender stood up well under the barrage, as he apparently had been a better student of political science than the others. The Milwaukee County Medical Society is conducting a series of presentations on recent advances in various branches in medicine. The Society registers about 75 members for these classes, and they conduct them as a regular feature of their program. There was much hilarity after the meeting, as Bob McDonald's experiences with exercise after 40 were recounted. He received a pair of skates for Christmas and promptly proceeded to fall down and break his arm. Long Jim, formerly Big Jim Kelley, had spliced a movie of himself in which shots varying 80 pounds in weight followed one another. Visits to Milwaukee are always pleasant occasions because of the genuine hospitality found there. I saw Harold J. "Speedy" Dvorak, Wisconsin undergraduate who took his graduate work here. He is practicing in Milwaukee with his wife, Laura M. Fisher. Many another Minnesota graduate came up to tell me of his genuine affection for his Alma Mater. Handsome and as debonnaire as ever, Maurice A. Hardgrove, one time graduate student at the University of Minnesota, is now married and is rapidly becoming domesticated....Wallace H. Cole, Director of the Division of Orthopedic Surgery, is leaving for England in December to join the group from the American Hospital Foundation. He will assist Dr. Philip Wilson and others in caring for the wounded. A born military man, Dr. Cole was a line officer before World War I. His father, a West Pointer, was quartermaster of the port of New York in the last war. Good luck, Wally, and may you return safely.....